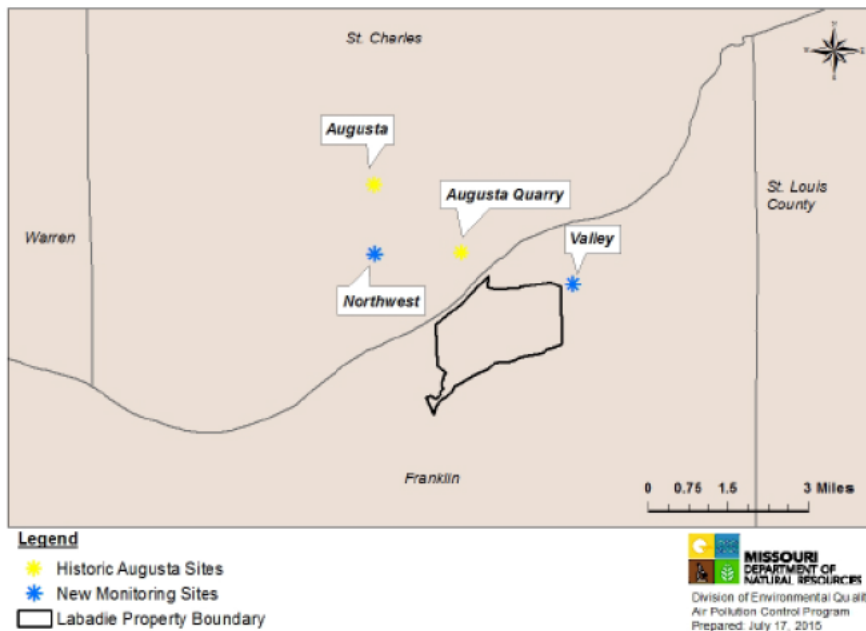


MDNR also included as part of their designation recommendation submittal monitoring data in the vicinity of Labadie. Historic monitoring occurred at two locations as shown in Figure 7 including the Augusta site from 1987-1994 and the Augusta Quarry site from 1994-1998. In addition, two new monitors were installed at different locations than the historic monitors (Northwest and Valley) and began collecting data on April 22, 2015. The data collected from the new monitors is for a short period and the resulting monitoring data has not yet been quality assured by Ameren, the entity responsible for operating these special purpose monitors. Because the monitoring data from the monitors is not yet quality assured and is for a limited period, the EPA performed no further analysis on this monitoring data for designation purposes. We did however perform additional analysis on the historic monitoring data to better understand the historic conditions leading to elevated hourly SO<sub>2</sub> readings.

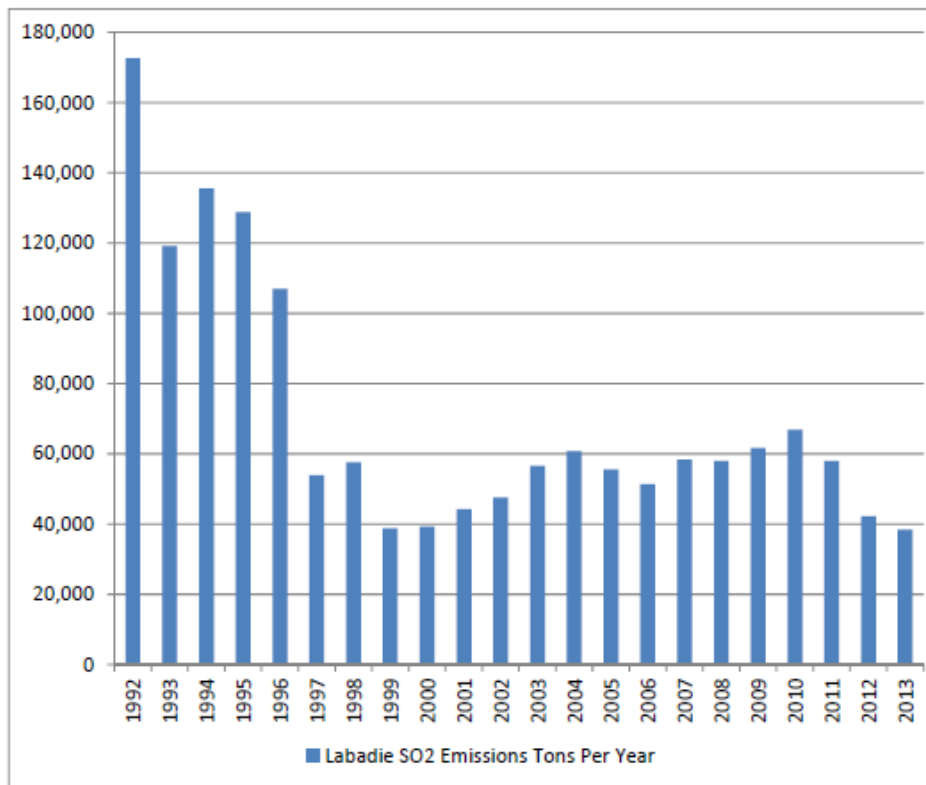
**Figure 7. New and Historic monitoring in and around Ameren Labadie Energy Center**  
New and Historical SO<sub>2</sub> Monitoring Sites around Ameren Labadie



In conjunction with the new and historic monitors, MDNR also provided information on historic annual emissions from the Labadie Energy Center. Figure 8 shows the historic trends of annual emissions from Labadie's 4 units combined.

**Figure 8. Labadie SO<sub>2</sub> Emissions Trends 1992-2013 (tons per year)**

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MDNR indicates that there were periods in the historic monitoring data where the fourth highest monitored SO<sub>2</sub> concentrations were below the 2010 1-hour SO<sub>2</sub> NAAQS. MDNR also points out that significant reductions in annual emissions have occurred at Labadie in recent years compared to the annual emissions in the early 1990's, around the time Ameren switched to burning a lower sulfur content coal. Because the form of the SO<sub>2</sub> standard is hourly, EPA chose to analyze the hourly emission rates and meteorological conditions that resulted in monitored values at the Augusta Quarry monitor that were over the new hourly NAAQS. EPA's analysis focuses on the year 1997, where the Augusta Quarry monitor had a 4<sup>th</sup> high daily value of 80 ppb and a maximum recorded value of 284 ppb. The year 1997 was chosen because annual emissions in 1997 appear to best reflect current annual emissions and it was the last historic monitoring year where a full year of monitoring data was available.

EPA gathered the publicly available 1997 CEM data from the Clean Air Markets website (<http://www2.epa.gov/airmarkets>) and analyzed the overall daily emission rates from the four Labadie units. Emissions ranged from 107,058 lbs per day to 850,911 lbs per day, with an

average of 295,485 lbs/day or approximately 148 tons/day of emitted SO<sub>2</sub> from the four units combined. Figure 9 below shows the range of daily emissions in 1997 in pounds per day.

**Figure 9. Daily emissions from 4 Labadie Energy Center Units in 1997**

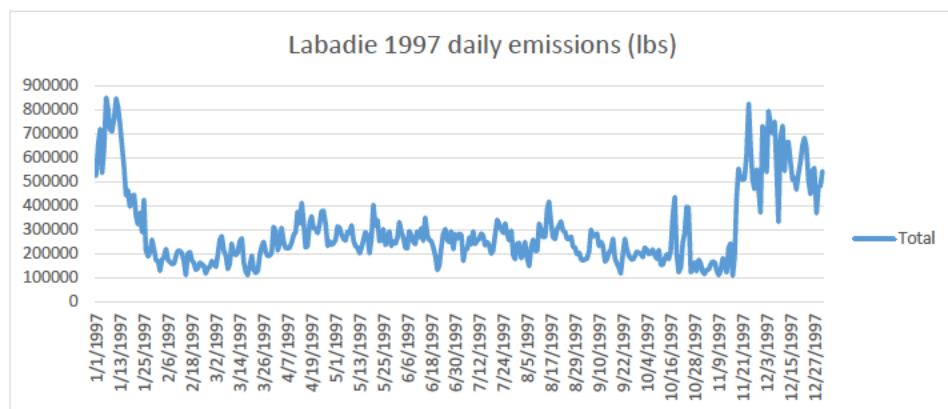
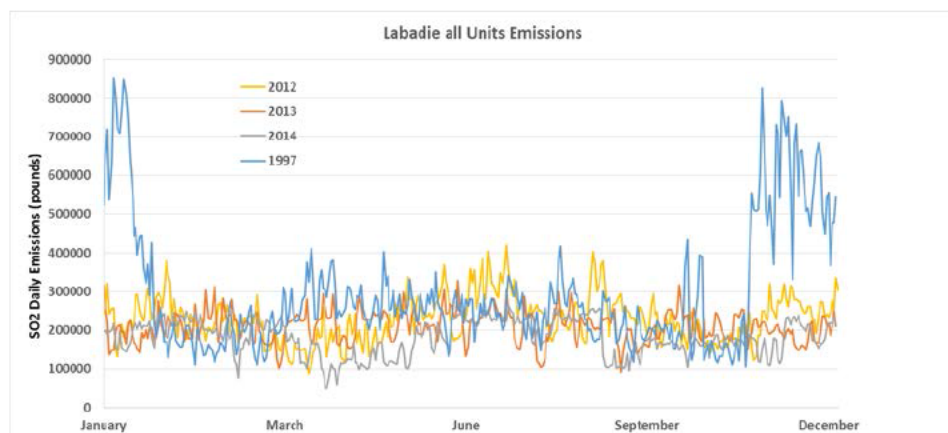
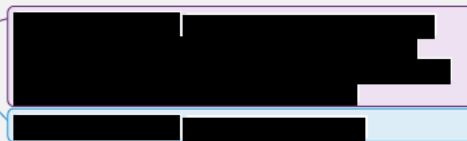


Figure 10 shows a comparison of the daily emissions from Labadie in 1997 to the 2012-2014 timeframe.

**Figure 10. Daily summary of emissions from Labadie for 1997 and 2012-2014.**



For the months of February – October, daily emissions in 1997 are similar to the daily emissions occurring from 2012-2014. Emissions were higher in January, November, and December of 1997 compared to 2012 – 2014, with daily SO<sub>2</sub> emissions ranging between 400,000 and 850,000 lbs



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per day during these months. For the 2012-2014 timeframe, Labadie does not have any days where the daily SO<sub>2</sub> emissions exceeded 410,000 lbs per day.

In 1997, there were four days where one or more hours recorded a concentration that would have exceeded the 75 ppb standard: 10/18, 01/14, 12/07, 03/16. The exceedances on 01/14 and 12/07 occurred on days in 1997 with large daily emission rates. The highest 1997 exceedance occurred on 10/18 during which the daily emissions were approximately 400,000 lbs. For comparison, the recent year 2012 does have days where the daily emissions are around 400,000 lbs. The 3/16 monitored exceedance occurred on days where the SO<sub>2</sub> emissions are in a similar range or below what were seen in the 2012-2014 timeframe. Further analysis of the four days listed above is provided in the following section.

For the following analysis, EPA gathered data from public sources such as CEM data for the Labadie units through EPA Clean Air Markets (<http://www2.epa.gov/airmarkets>), monitoring and meteorology data from the EPA AQS system (<http://www3.epa.gov/airdata>), and meteorology data from the NWS for the Jefferson City Airport. In the windrose analysis for each day, EPA included a windrose from both the Jefferson City NWS site, which is the surface location used in the MDNR modeling, and onsite meteorological data collected at the Augusta Quarry site and reported to the EPA AQS system.

#### 10/18/1997 – 284 ppb maximum 1-hr concentration

Labadie had 2 units (Units 2 and 4) operating on 10/18. The majority of the emissions on this day were from Unit 2. Emissions averaged 18,166 lbs/hr during this day. The Augusta Quarry site monitored 5 consecutive hours of high SO<sub>2</sub> on this day, starting at noon and ending at 4:00 PM. Winds were relatively light from the ESE. The measured 1 hour peak on this day was 284 ppb, approximately 3.79 times the 75 ppb NAAQS. [This indicates that, under the meteorological conditions that occurred on this day, an hourly emission rate from Labadie units of  $18,166/3.79 = 4,797$  lbs/hr could have resulted in a 75 ppb monitored value at the Augusta Quarry site]



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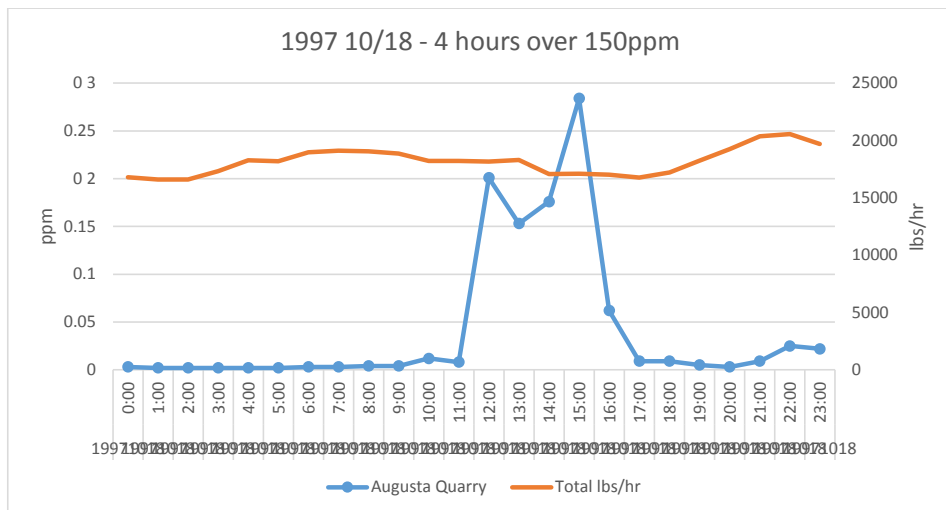
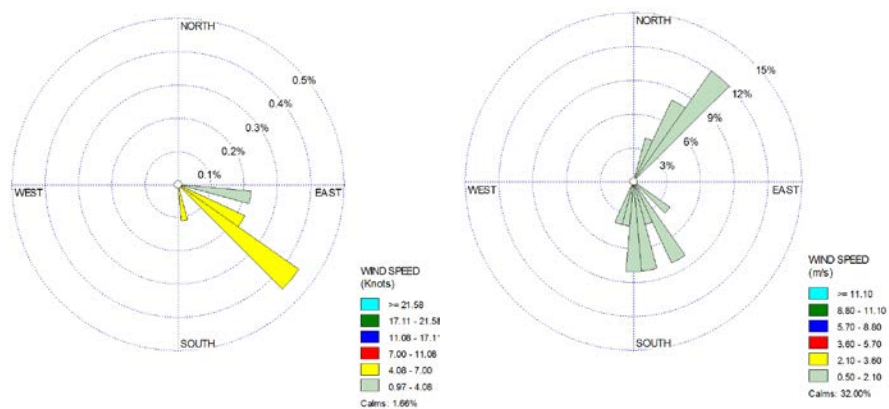


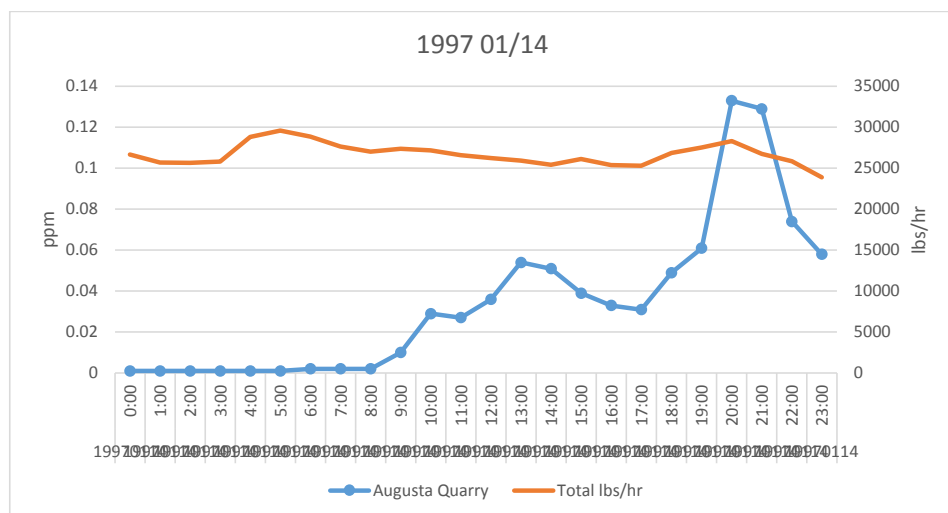
Figure 11: Hourly emissions, monitor concentration and windrose on 10/18/1997

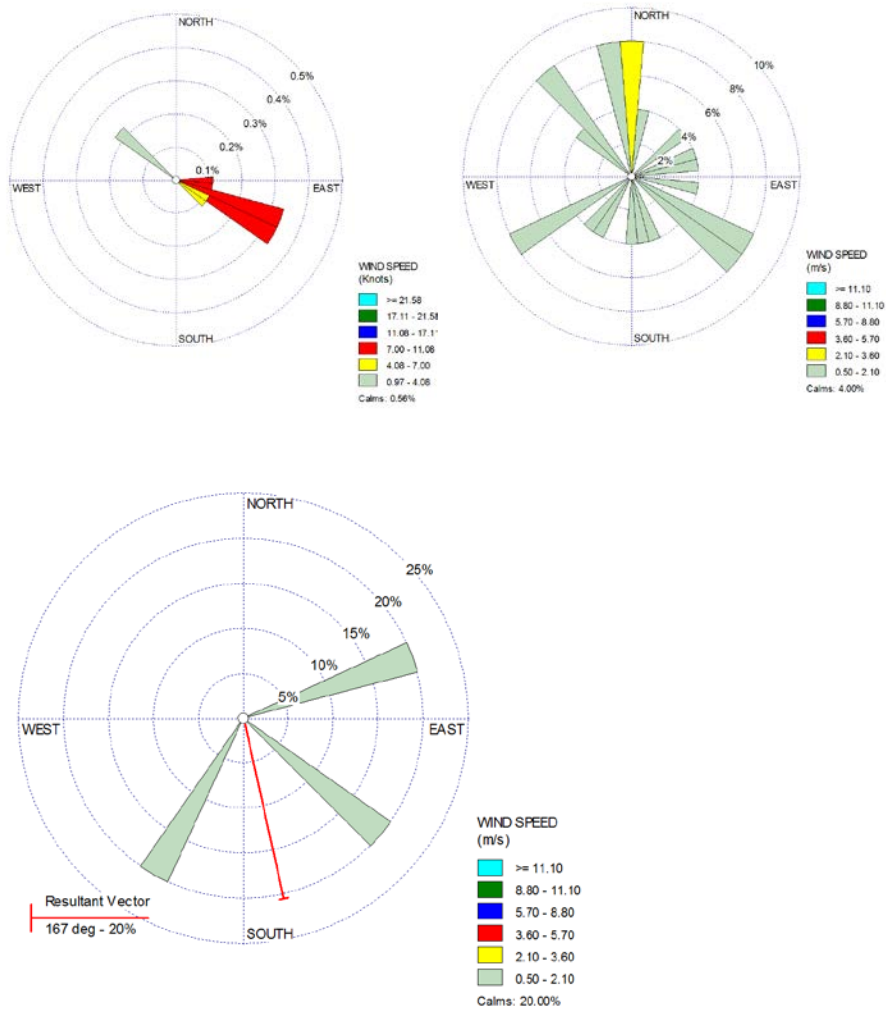


### 01/14/1997 – 133 ppb maximum 1-hr concentration

Labadie had all 4 units operating on this day with the majority of the emissions from Units 3 and 4. Overall emissions averaged 26,697 lbs/hr throughout this day and hourly rates were fairly constant. High readings were measured during the evening hours, 8:00-9:00 PM, but elevated levels were measured starting at around 10:00 AM on this day. Winds were from the ESE during most hours during this day according to the NWS dataset, while the onsite data shows fairly calm winds from varying directions but from the south during the hours with peak concentrations. The 1 hour peak on this day was 133 ppb, approximately 1.77 times the 75 ppb NAAQS. This indicates that, under the meteorological conditions on this day, an hourly emission rate from Labadie units of  $26,697/1.77 = 15,055$  lbs/hr could have resulted in a 75 ppb monitored value at the Augusta Quarry site.

**Figure 12. Hourly emissions, monitor concentration and windrose on 1/14/1997.**



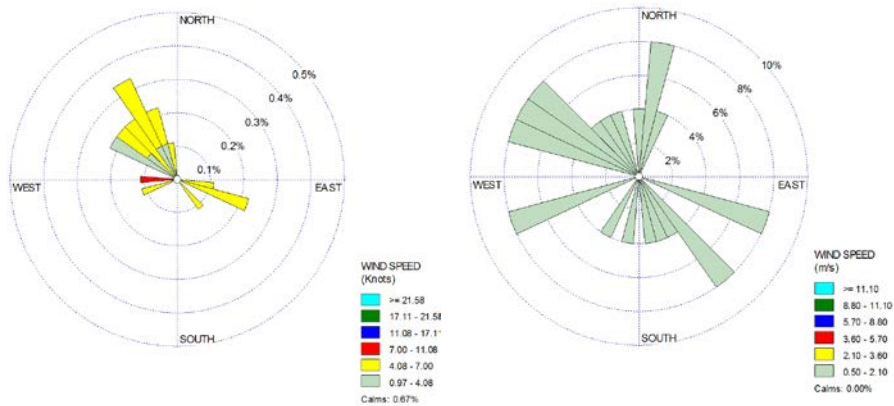
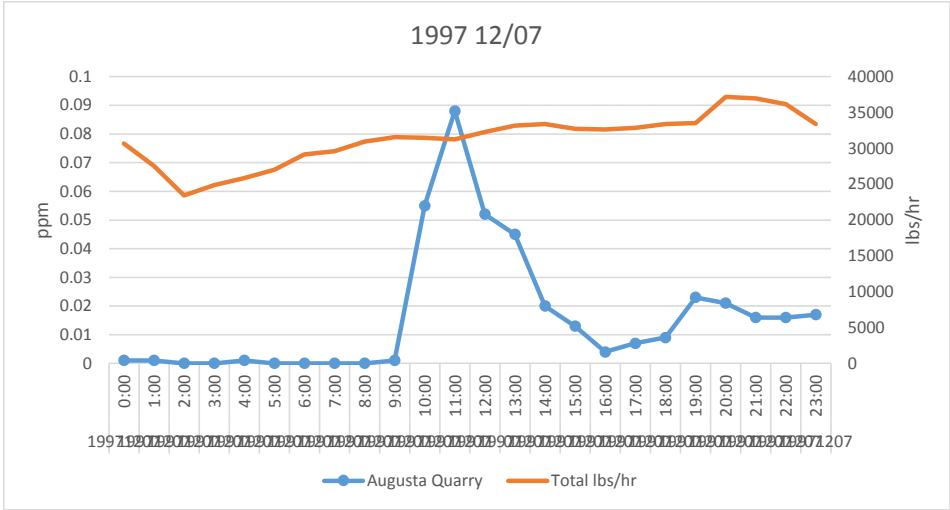


#### 12/07/1997 – 88 ppb 1-hr maximum concentration

Labadie had all 4 units operating on this day with the majority of emissions from Units 1 and 2. Overall emissions averaged 31,295 lbs/hr throughout this day and hourly emission rates increased into the evening hours. High readings were measured during morning hours. The emissions peaked at 11:00 AM but elevated levels were measured starting at around 10:00 AM on this day. Winds were predominantly from the NW and from the ESE during this day

according to the NWS site. The onsite meteorological data showed more variability with light winds throughout the day. The 1 hour peak on this day was 88 ppb, approximately 1.17 times the 75 ppb NAAQS. This indicates that, under the meteorological conditions on this day, an hourly emission rate from Labadie units of  $31,295/1.17 = 26,671$  lbs/hr could have resulted in a 75 ppb monitored value at the Augusta Quarry site.

**Figure 13. Hourly emissions, monitor concentration and windrose on 12/7/1997**

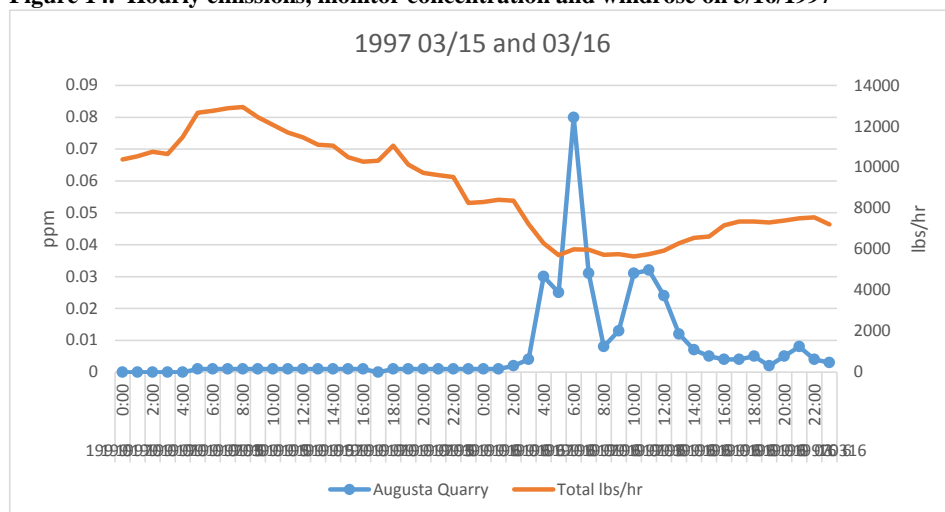


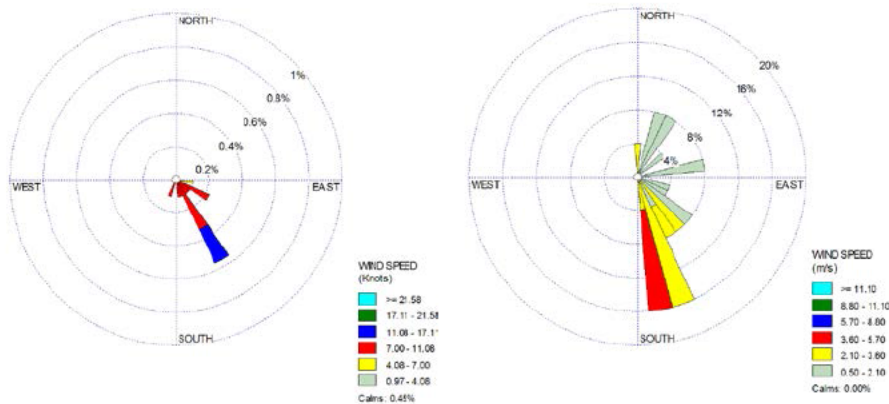


### 03/16/1997 – 80 ppb 1-hr maximum concentration

Labadie had all 4 units operating on this day although the 4<sup>th</sup> unit was operating only in the early morning hours. The majority of the emissions were from Units 1 and 2. Overall emissions averaged 6,813 lbs/hr throughout this day, which was fairly low in comparison to other days in 1997. High readings were measured during morning hours (6:00 AM) but elevated levels were measured starting at around 4:00 AM. Winds were from the SSE during this day at both the NWS and onsite meteorological stations. Because the peak monitored value occurred in the early morning hours, EPA also looked at emissions from the prior day on 3/15/1997. On that day, the average emission rate was higher, averaging 11,016 lbs/hr. However, 10 hours preceding the monitored exceedance the average hourly rate is 8,149 lbs/hr. The 1 hour peak on this day was 80 ppb, approximately 1.07 times the 75 ppb NAAQS. This indicates that, under the meteorological conditions on this day, an hourly emission rate from Labadie units of  $6,813/1.07 = 6,387$  lbs/hr could have resulted in a 75 ppb monitored value at the Augusta Quarry site.

**Figure 14. Hourly emissions, monitor concentration and windrose on 3/16/1997**

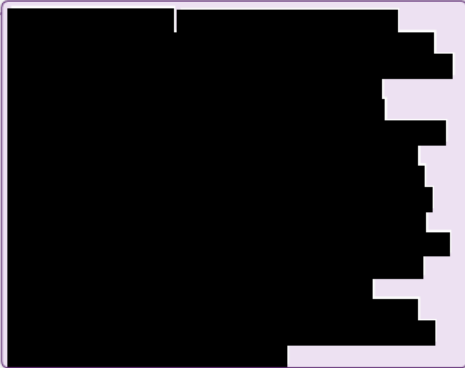




It appears from this analysis that the Augusta Quarry monitor catches a plume from a nearby source in 1997 since, for all individual days analyzed, the monitor records very low hourly concentration values, then a spike in concentrations for a few hours and finally returns to a low value. Given the proximity of Labadie and the wind direction during monitored spikes, it appears that the Labadie Energy Center emissions are the cause of the elevated monitored values in 1997.

An analysis of emissions during the four historic days in 1997, where measured concentrations were above the new 75 ppb 1-hr NAAQS, indicates both high and low hourly emission rates can cause elevated hourly measured concentrations. This analysis appears to indicate that meteorological conditions play a significant role in determining whether a monitor at the Augusta Quarry location would record values above the current 1-hour SO<sub>2</sub> NAAQS, possibly outweighing the hourly emission rate. It is also appears that on all four days that were analyzed above, winds were from a direction that would transport Labadie emissions to the Augusta Quarry monitor. Based on the analysis above, it appears that hourly emission rates from Labadie that were typical during 2012 – 2014 could produce a concentration at the Augusta Quarry monitor location that would be above the 1-hour SO<sub>2</sub> NAAQS. For example, on 3/16/1997, the average hourly rate from all four units was 6,813 lbs/hr, which equates to less than 30,000 tons/yr if this emission rate is assumed for all hours during a year. The Augusta Quarry monitor recorded a concentration of 80 ppb on that day. As seen in Figure 15, 81% of the days from the 2012 – 2014 period have average daily hourly rates from all Labadie units greater than 6,813 lbs/hr. In fact, we see evidence that an hourly emission rate as low as 4,797 lbs/hr may cause a monitored value above 75 ppb at the Augusta Quarry site. During 2012-2014, there were 24,880 hours with total emissions at or greater than 4,797 lbs, which represents over 94.5% of all hours in 2012-2014.

Given that the local meteorological conditions and terrain are unlikely to have changed significantly since 1997, the SO<sub>2</sub> emission rates from Labadie in 2012-2014 could be capable of contributing to an exceedance of the 75 ppb NAAQS in the vicinity of the historic monitors.

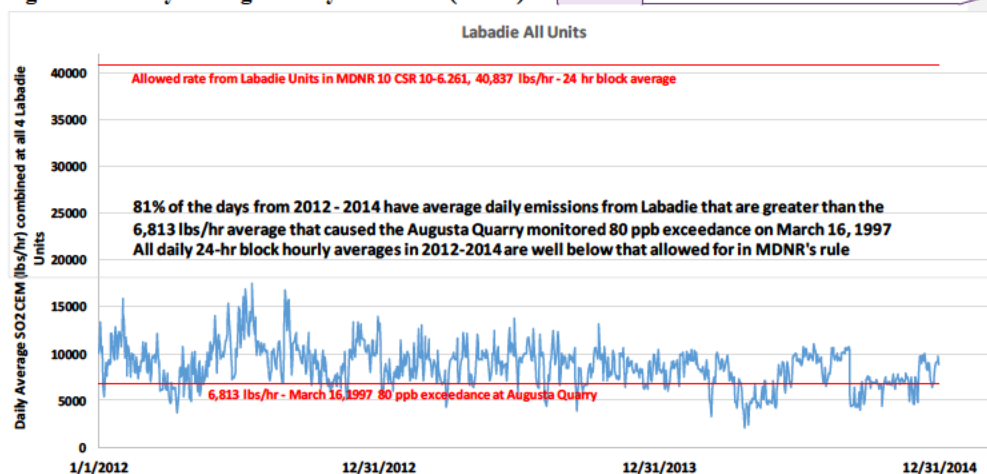


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There are two other days that show historic exceedances in 1997. The average hourly emission rates was 4,797 lb/hr on 10/18/1997 and 15,055 lb/hr on 1/14/1997. Both of these average hourly emission rates fall within the range of the current average hourly emission rates from the Labadie Energy Center. Based on this analysis, current hourly emission rates from the Labadie Energy Center could result in monitored exceedances of the current 1-hour SO<sub>2</sub> NAAQS.

EPA notes that MDNR's latest SO<sub>2</sub> rule, 10 CSR 10-6.261, allows Labadie to emit 40,837 lbs/hr using a 24 hour block average. This emission rate exceeds the rate that Labadie emitted at on the days where the Augusta Quarry monitored concentration was above the 2010 1-hour SO<sub>2</sub> NAAQS. This emission rate is also above the 2012-2014 rates used in the MDNR modeling that showed violations.

Figure 15. Daily average hourly emissions (lbs/hr) at Labadie.



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#### Conclusion

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